IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: APOSTOL KONOMI	Examiner: Sharon E. Payne
Serial No.: 09/824,966	Group Art Unit: 2875
Filed: 04/03/2001	Attorney Docket No.: 99-070-JK
Title: DOUBLE-SIDED EDGE LIGHTING -TYPE DISPLAY LIGHT BOX	Real Party In Interest: Apostol Konomi

BRIEF ON APPEAL

Mail Stop Appeal Brief-Patents
Commissioner for Patents
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Status of Claims

Claims 1, 5, 7, 9, 10, 12, 13, 15, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30 and 31 are the subject of this appeal. No other claims are pending.

Status of Amendments

There was an amendment filed After Final Rejection of July 15, 2003. The amendment cancelled Claims 2, 3, 4, 6, 8, 11, 14, 16, 17 and 19 and added claims 20 - 31.

Summary of Invention

The present invention presents a light box that uses standard light sources supported along at least one peripheral edge of the display sign to illuminate display signs on one or two opposing faces of the display sign. The present system eliminates the quandaries encountered regarding cancellation of rays and travel distance, with a tangible, mathematically sound

solution. In the present double-sided edge lighting system, the light rays provided are not left to spurious travel, to then later be refracted. Similarly the present invention is designed to prohibit rays from merely reflecting off of the housing, thus leaving rays free to travel, which obviously leads to cancellation rays, and ergo, less illumination. The double-sided edge lighting-type display sign of the present invention comprises a light box housing, at least two illuminating light sources, at most two display signs and a two-sided or four-sided light-directing panel. The light box housing accommodates and supports the other elements of the present invention. Namely, the light box housing supports at least two light sources, the display signs and the light-directing panel

The light source is located along at least one edged of the light box housing. By locating the light source along the edges of the light box housing, the required depth of the light box disclosed herein can be kept to a minimum. Thus, the light box needs only to be as thick as the light sources housed herein. In one embodiment of the present invention, the light source is a pair of standard fluorescent light bulbs located along opposing edges of the light box housing. Since standard fluorescent light bulbs are not very wide, the depth of the light box can be kept to a minimum. Additionally, this embodiment can be easily serviced, since the voltages and components normally used in fluorescent bulb circuits do not require a skilled or certified technician for replacement or servicing thereof. The light source for the present invention is not limited to fluorescent bulbs or any other particular light source disclosed herein. By way of example only and not as a limitation, the light source may be incandescent bulbs, krypton bulbs, bar lighting, fiber-optic lights, as mentioned fluorescent bulbs, or any other light source.

The light source of the present invention should optimally provide a uniform distribution of light across the entire display signs area so that the display signs are uniformly illuminated.

Uniform dispersion of the usable light, provided by light source, may be achieved by using reflective housing in the regions surrounding the light source so that light rays tending not to be directed towards the display signs are redirected toward the display signs or a light-directing panel or panels, discussed in greater detail below. In one embodiment, the light housing surrounding the light source is formed of reflective material or coatings such that rays of light not originally directed toward the display signs or the two-sided light-directing panel are reflected and redirected toward display signs or the light-directing panel. In addition to the redirecting reflective housing for redirecting light rays toward the display signs or the light-directing panel, one embodiment of the invention may encompass a light box housing including interior surfaces substantially coated with reflective coatings, designed so that light rays not initially directed towards the display signs or two sided light-directing panels, are redirected thereto.

The display signs of the present invention comprise transparent or semi-transparent panels coated with a desired graphical design display. The display signs are usually placed on at least a portion of what constitutes at least one face of the light box housing. Light from the included light source located along the edge of the light housing, backlights the display signs. The display signs in one embodiment are comprised of the desired graphical design, which is stamped on the face of a transparent film or paper material. This genre of display sign possesses the characteristics of being easily and inexpensively manufactured and replaced. Included within this grouping of display sign is X-ray radiographs. It is therefore clear that the present invention may be adapted for many uses other than displaying advertising signs and is thus not limited to any one application.

The display signs used in the present invention may be designed to be weather-resistant and protect against fading, peeling or other degradations where the light box would be exposed to the elements of the sun, heat, cold, moisture, etc. Alternatively, the display signs may be constructed with a protective panel next thereto for protecting the display signs from weather elements.

The light-directing panel of the present invention functions to effectively direct a maximum amount of the useable light from the included light source towards the display signs. The display signs are therefore illuminated with the maximum amount of useable light provided by the light source. This results in two backlit display signs that are more visible than conventional light boxes and thus, a better light box system. The double-sided light-directing panel of the present invention may comprise a panel, having portions thereof coated or treated with a material having an index of refraction greater than the index of refraction of the uncoated or untreated portion of the light-directing panel. The light-directing panel, thus functions to direct light rays incident to its coated surface, toward the display sign, located on the side adjacent to the origination point of the light ray. The light-directing panel of the present invention also allows light incident upon the uncoated portions of the light-directing panel to pass through the light-directing panel and illuminate the display sign located on the side opposing the origination point of the light ray. In this manner, the display signs of the present invention are illuminated with the maximum amount of the light from the light source.

In one embodiment of the invention, the amount of surface area having a higher index of refraction than the uncoated, two-sided, light-directing panel approximately equals the amount of surface area of the uncoated two sided light-directing panel. The advantage of this embodiment is that the light incident on either side of the light-directing panel has an equal chance of either

being directed back toward the display sign located on the same side as the light ray origination point or passing through the uncoated and lower index of refraction portion of the light-directing panel light towards the display signs located opposite the origination point of the light-directing panel. The opposing display signs therefore, are equally and uniformly illuminated, by the uniformly dispersed light, created by the light source as described above.

In prior light box systems, the positioning of the lamps behind the image creates a lighting scheme encompassing bright rays and less bright rays. Due to the uneven lighting of the object, which occurs with the differing strengths of rays, a means to reconcile the strength of the rays, in order to best serve the dual image configuration of the instant invention, must be developed. Thus, in a further embodiment, the double edge light display sign allows for better illumination of the two signs, by utilizing a prismatic shaped, four-sided light-directing panel. The four-sided light-directing panel creates a higher intensity, more uniform illumination, by augmenting the rays with the farthest distance to travel. This is accomplished through the angling of the panel sides towards the sign, as the distance a ray must travel from the source increases.

The base of the prismatic light-directing panel may be made in the shape of a rhombus and the prismatic light-directing panel may be manufactured from smooth white plastic. The prismatic light-directing panel may be opaque or painted with a white fluorescent paint in order to exhibit stronger and fuller reflective qualities.

This embodiment serves as a better means for illumination since the prismatic light-directing panel allows for the back-to-back construction of the display signs and uniform lighting, without each display sign interfering with the other's lighting scheme. This

embodiment also allows for a very thin unit as compared to prior art units. In the present embodiment, the panel's width can range from 1.5 to 2.5 inches or specifically 37 to 65 mm.

In the traditional light boxes, the positioning of the lamps behind the image inherently creates a lighting scheme encompassing some highly radiant rays and some less radiant rays, due to the direct application of the lamps. The laws of physics, through the equation $E=(L\cdot \cos a)/R^2$ dictate that the further away the source of light, the less illumination is present. However, the placement of many lamps behind the picture for a brighter illumination, not only increases the cost of production, but also makes the construction difficult to manage. Also, in order to house two opposing pictures, the panel would have to be thicker and larger, and thus harder to move and maintain when malfunctions occur. A mechanism, such as the one just described above, may also require a specialist for repair and replacement of the pictures. Also, the utilization of many lamps is economically inefficient since the increase in the consumption of electrical energy can be extensive.

To eliminate these disadvantages, a system with two fluorescent lamps, placed on the side of the displays and inside the aluminum frame may be introduced. Due to the novel construction of the instant display sign, the profile plays a major role in the function of the sign. The sign is designed with such a narrow width that it is easy to move, and fit into tight spaces. The owners themselves can change the display signs with little difficulty, and thus, the instant display sign saves electrical energy, along with providing maximum and uniform illumination of the two displays.

The construction of this instant display sign is based upon symmetry. This is achieved with the aid of the four-sided light-directing panel, which, with its rhombus shape, helps to channel the quantity of the rays that are needed for the illumination of the two displays of the

panel. On the two displays, except for the quantity of rays that fall from the two lamps, there is also a quantity that is sent from the light-directing panel with reflected rays, in this way intensifying the illumination of the rays. When the lamps are placed on the sides of the two displays, without a light-directing panel in between them, the displays are well lit on the sides and gradually less lit in the middle. This phenomenon is eliminated with the use of the four-sided light-directing panel. The displays not only have stronger illumination, but are also illuminated more uniformly and symmetrically. Here, it is important to stress that this strong and uniform illumination is achieved by positioning the lamps within a certain distance of each other, depends on the quantity of the lamps.

When the intensity of the light from the lamps is greater, naturally, the distance between those two lamps can be proportionally greater. From experimentation, it has been determined that the distance between the two lamps should not be greater than 0.6 to 0.65 of their length. For example, if the lamp is 30 inches long, then the distance between the lamps should be around 18 to 20 inches. The four-sided light-directing panel, being a prism with a rhombus shaped base, possesses four symmetric, reflective surfaces. These four surfaces of the panel aid in the reflection of the rays from the lamps to the display signs, and for this reason, near perfect reflection may be exhibited. This is achieved due to the construction of the four symmetric sides, which may be made of white plastic, opaque (non-transparent) or painted, with a fluorescent white paint as seen on reflective street signs. The sides of the four-sided light-directing panel can also be made of mirror quality glass, but the cost would be much higher.

As such, the method of making and using the device detailed above constitutes the inventor's preferred embodiment and alternate embodiments to the invention. The inventor is aware that numerous configurations of the device as a whole or some of its constituent parts are

available which would provide the desired results. While the invention has been described and illustrated with reference to specific embodiments, it is understood that these and other embodiments may be resorted to without departing from the invention. Therefore, the form of the invention set out above should be considered illustrative and not as limiting the scope of the following claims.

Issues

Issue 1 – Whether claims 1, 5, 6, 7, 9, 10, 12, 13, 15 are unpatentable over Easterday et al. (U.S. Patent 1,931,577) in view of Ashall (U.S. Patent 5,625,968) under 35 USC 103(a)?

Issue 2 – Whether newly added claims 20 - 30 are patentable.

Grouping of Claims

For each ground of rejection which appellant contests herein which applies to more than one claim, such additional claims, to the extent separately identified and argued below, do not succeed or fail together. This goes for the claims presented in the amendment after final filed with this Appeal.

The Argument

Issue 1 – Whether claims 1, 5, 7, 9, 10, 12, 13, 15 are unpatentable over Easterday et. al. in view of Ashall under 35 USC 103(a)?

Independent Claim 1 claims a double-sided edge lighting-type display box comprising two display signage panels, having a desired design face; at least two light sources offset from and behind said two display signage panels; and a light directing panel located behind at least one of said two display signage panels; whereby light directly incident on said at least one display signage from said at least two light sources and redirected light from said light-directing

panel backlight and illuminate said two display signage panels, or at least one display signage panel. Claims 5, 7, 9, 10, 12, 13, 15 are dependent on Claim 1.

The Examiner rejected claim 1, 5, 6, 7, 9, 10, 12, 13, 15 because the Examiner believes it would have been obvious to one of ordinary skill to use the second light source of Ashall in the apparatus of Easterday for providing light. In response, applicant submits the following arguments:

The panels' main function is to illuminate the display signs. In Easterday's patent, two parallel display signs are illuminated with one incandescent light source that is placed in the center of the panel and behind the display signs. In Konomi's patent application, two parallel display signs are illuminated by two linear fluorescent light sources placed on the sides of the panel that achieve a proportionate and uniform illumination. This is not the case in Easterday et al. In Ashall's patent one fluorescent light source is used which does not illuminate the display signs. Furthermore, the suggestion of use of a second light in Ashall is applied only to "very large signs." See Ashall Column 3, line 16 (5,625,968). This shows the great design differences between the prior art and the present invention.

In regard to claim 1, neither Easterday nor Ashall possess a light reflecting panel with a configuration remotely resembling that of applicant's invention. Further, both inventions not only teach away from the present invention, both inventions clearly exhibit the problems the present invention was designed to address.

In regard to Easterday, as shown below, cancellation of rays, (the eradication of which is main thrust of the instant invention), occurs at the focal point of the bulb, as the v-shaped, allegedly reflective, member attempts to divided the rays but instead reflects the focal rays into the incident freely traveling rays.

Further, in Ashall, as shown below, the "matrix of dots" on one surface, utilized by Ashall, teaches away from the reflective mechanisms utilized by the present invention, since the dots not only limit the amount of light transferred to the signage but also tend to create a multitude of ray cancellations through the disturbance of the ray paths.

Thus, as the Applicant maintains that both Easterday and Ashall lack the requisite teaching which would lead one skilled in the art at the time of the invention to combine the partially illuminated sign in Ashall with the light source offset from and behind the two display signage panels of Easterday and since the combination of these references fails to yield a proper working invention, the instant invention cannot be unpatentable over Easterday in view of Ashall under 35 USC 103(a).

Under the obviousness standard prior art is required to teach. *In re Wilder*, 429 F2d. 447, 166 USPQ 545, 548 (C.C.P.A. 1970). In addition, the mere fact that references can be combined does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. *In re Mills*, 916 F.2d 680, 16 USPQ 2d 1430 (Fed. Cir. 1990).

Further, in accordance with the tenets of patent law,

> The Federal Circuit has stated that "obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching suggestion or incentive supporting the combination." In concluding that obviousness was established by the teachings in various pairs of references, the district court lost sight of the principle that there must have been something present in those teachings to suggest to someone skilled in the art that the claimed invention before the court would have been obvious.

See *In re Geiger*, 815 F.2d 686, 2 USPQ 2d. The Applicant maintains that neither Easterday nor the knowledge generally available to one of ordinary skill in the art would suggest combining Easterday and Ashall.

When the motivation to combine teachings of the references is not immediately apparent, it is the duty of the examiner to explain why the combination of the teachings is proper. *Ex parte Skinner*, 2 USPQ 2d. 1788 (Bd. Pat. App. & Inter. 1986). In this case, the Examiner has presented no explanation to support the combination of Easterday and Ashall. It is impermissible to use the claimed invention as an instructional manual or "template" to piece together the teachings of the prior art so that the claimed invention is rendered obvious. This court has previously stated that "[o]ne cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention. *In re Fritch*, 972 F. 2d 1260, 23 USPQ 2d 1780, 1784 (Fed. Cir. 1992)(quoting *In re Fine*, 837 F.2d 1071, 1075, 5 USPQ 2d 1596, 1600 (Fed. Cir. 1988)). Clearly, since the principle of operation regarding light ray implementation differ drastically between Easterday and Ashall as opposed to the instant invention, combination of the inventions disclosed in Easterday and Ashall to create the instant invention is wholly unreconcilable.

Additionally, as shown below, where prior inventions involved little to no calculation of ray for maximization of usage, the instant invention wholly maximizes usage of all available light rays. The examiner has utterly refused to take into consideration the mathematical proof, model in review of the application.

Further, while differences in dimensions are obvious where changes in dimensions would not cause a device to perform differently, changes in dimensions which effect performance and effectiveness of a new device are nonobvious. See Gardner v. TEC Systems, Inc., 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), *cert denied*, 469 U.S. 830, 225 USPQ 232 (1984); MPEP §2144.04(IV)(A.). As shown below, the dimensional relationship developed by the instant invention and ignored by the Examiner stands quintessential to proper illumination. Moreover,

as shown by the extensive calculations appended by the applicant as part of this appeal and also as part of the responses to previous Office actions, the addition of the two properly angled sides for reflective and refractive purposes is a major component that greatly enhances the ability of the instant invention to prevent cancellation of rays and produce complete illumination.

The box's dimensions are in variation according to the light sources' diameter, which is mentioned in the application's paragraph 47. The lamps' diameters are 16 mm, 26 mm and 38 mm for lamps T5, T8 and T12 respectively. The box's width is approximately 1 inch larger than the diameter of either lamp that is being used. Therefore, we have three different box sizes, 37 mm, 52 mm and 65 mm respectively. It is not possible to use larger boxes with these lamps, as that will prevent us from utilizing the maximum amount of light to successfully illuminate the display panels. Easterday does not disclose the dimensions of the box, neither is this a variation in design.

Regarding claim 5, the Examiner states that Easterday's light directing panel 26 has four sides. However, Easterday only suggests that two sides be used to reflect light. The inner sides of the panels are not utilized in the device nor suggested to reflect light for the sign panels.

In applicant's invention, light rays originating from the light source are used to illuminate the desired faces. However, it is not possible that Ashall's transparent sheet 10 directs light toward the display signs. No direct rays that originate from the light source 21 goes through surfaces 11 and 12. All rays either go through the parallel surface to the light source, which is the top surface of the panel, or are contained within the transparent sheet 10. The illumination of the desired faces in the Ashall invention is minimal.

Examiner rejected Claim 7 because Examiner believed that Easterday et al. discloses a light directing panel that is completely non-transparent. In response, applicant submits the following arguments:

Regarding claim seven, Easterday's light directing panel 26 may also be non-transparent as is Konomi's light directing panel 50, however, the shape as well as the positioning of these two light directing panels are completely different. Positionings that effect performance and effectiveness are nonobvious differences in applicant's invention.

Examiner rejected Claim 9 because Examiner believes that the claim is obvious over Easterday et al. in view of Ashall. In response, applicant submits the following arguments:

In figure 1 in Easterday et al, the lamp's distance from the middle of the display signs and from the sides of the display signs is different. The illumination in these two parts is also different. In Konomi's patent application, the two light sources are equidistant from the display signs and the illumination is uniform. Ashall's use of second light source is only for very large signs.

Examiner rejected Claim 10 because Examiner believes that Easterday et al. discloses two display signs having the same height and length. In response, applicant submits the following arguments:

The difference between Easterday and applicant's panels is the surface these display panels cover in each panel. In Easterday's panel, display signage panel 18 covers only about 1/3 of the overall box. In applicant's panel however, the two display signage panels cover the entire surface of the panel.

Examiner rejected Claim 12 because Examiner believes that Easterday discloses a light directing panel that is substantially the same height as the two display signage panels. In response, applicant submits the following arguments:

Easterday does not discuss the angle formed by the two sheets of light directing panel 26 which determines the height of the light directing panel and the two display signage panels. When this angle is made smaller, the height of the light-directing panel 26 as well as the two display signage panels grows and the illumination given by light source 14 is minimized. On the other hand, if this angle is made larger, the height of the light-directing panel 26 as well as the two display signage panels is made smaller and has 0 as a limit. In applicant's panel, the height of the light-directing panel 8 as well as the height of the two display signage panels are dependent on the height of the light sources and cannot be smaller or larger.

Examiner rejected Claim 13 because Examiner believes that the claim is obvious over Easterday et al. in view of Ashall. In response, applicant submits the following arguments:

The response to this rejection is similar to that of claim 12, however, the light-directing panel's height has no connection with the lamp's size.

Examiner rejected Claims 14, 15, and 16 because Examiner believes that the claim is obvious over Easterday et al. in view of Ashall. In response, applicant submits the following arguments:

Easterday et al. discloses the interior of the housing is at least partially reflective surface for reflectively directing light toward the two display signage panels, however, Applicant's device has a parabolic reflector placed behind the light sources to maximize the illumination of the two display signage panels. (Fig. 13 & 22) In regards to the rigidness of the housing, it is

impossible to create a housing that will protect its components from destruction, without it being constructed of rigid material.

Examiner rejected Claim 17 because Examiner believes that the claim is obvious over Easterday et al. in view of Ashall. In response, applicant submits the following arguments:

The examiner refers to Easterday's wire that connects the lamp to the plug as the electrical circuitry when Konomi refers to the wire as the line which is only one part of the electrical circuitry. Konomi's electrical circuitry consists of two ballasts, two starters, two fluorescent lamps and the wiring, components that are well positioned within the housing without interfering with the illumination of the two display signage panels. It is quite simple and it requires no special skill to accommodate a small piece of wire, however it is a challenge to accommodate a number of things in such a thin housing.

The following is a general summary of the main differences between applicant's invention and Easterday et al.:

1. The lighting given by the light source(s) and the percentage of that illumination that is actually used towards our goal.
2. The types of lamps used.
3. The number of lamps used.
4. The positioning of the lamps.
5. The types of the light-directing panels used.
6. The size of the display signage panels.
7. The panels' dimensions.
8. The uniform illumination of the display signage panels.
9. The general construction of the panels.

Regarding claim 15, applicant's invention is predicated on use of the entire interior surface area for optimal output. Thus, since Ashall operates in the different manner, any teaching toward Kashima et al that may be found would fail to render applicant's invention obvious, since utilizing a partially reflective surface would not optimize ray output.

Applicant's patent application stresses that the panel's design is based on the terms of symmetry in plane and in space. (Paragraphs 46, 50, 58, 60, 61, 75, 76, 78). This panel has a center O that is the symmetrical center of the panel. (Paragraph 61) Every point in the panel and every part of the panel has it's own symmetrical point and part respectively in connection to the center O of the panel. As a result of this symmetry every symmetrical point or part is equal. For example, the two lamps, the two plastic sheets, the aluminum parts and other parts, are equal. All these serve toward the main function of the panel, which is to maximize the illumination of the two symmetrical display signs. Symmetrical light sources give symmetrical illumination, which means the illumination offered by the two light sources is equal. This feature is not mentioned in Easterday et al, in Ashall or in any cited patents. Therefore, applicant's invention is a new application of scientific optical principles and not merely an obvious variation of previous attempts.

At first glance it seems as though they are similar panels, because they illuminate two parallel pictures, with one light source in Ashall's panel and two light sources in Konomi's panel. However, in regards to the examiner's reference of Ashall's transparent sheet 10 as a light-directing panel (Concerning claims 1, 5, 7, 9, 10, 12, 13, 15), nowhere in Ashall's patent is this transparent sheet 10 referred to as a light-directing panel. The sole use of the light-directing panel is to direct light towards the desired face or faces. The transparent sheet however, is

unable to serve this purpose as proven by several optical physics laws, which is explained in full detail in the following pages.

A detailed analysis of the main differences follows:

I. These two panels are different in the optical laws they follow.

In Konomi's application the optical laws that are followed are for the reflection of the light from straight surfaces. In Ashall's patent the optical laws that are followed are for the refraction of the light in different optical ambient; for example, from air to glass, from air to plastic etc. and the other way around, glass-air, plastic-air etc. As a result, due to this main difference, the means of the panels' realization are different as well as the functionality of the panels' parts, no matter if some means used, such as the lamps or the plastic, are similar.

II. The illumination of the desired faces in Konomi's panel and Ashall's panel is different.

In Konomi's application it is shown in detail which rays originating from light source 12 and light source 14 are used to illuminate the desired faces, and how parts of the rays are directed by the light-directing panel 8 or the light-directing panel 50, whichever is in use, to increase the illumination of the desired faces. In Konomi's application it is also shown how the rays that originate from the back part of light source 12 and light source 14 are used, as well as how the illumination is increased. (Fig. 12) Therefore the maximum illumination that is given by light source 12 and light source 14 is used.

In Ashall's patent it is not shown why transparent sheet 10 is called and serves as a light-directing panel. Further, it is never stated which rays of light source 21 are directed by the transparent sheet 10 towards surfaces 11 and 12. Thus no direct ray that originates from light source 21 goes through surfaces 11 and 12. All rays either go through the parallel surface to the light source, which is the top surface of the panel, or are contained within the transparent sheet

10. In the desired faces 11 and 12, no rays will come through even if we place four light sources on the transparent sheet 10, in other words, on all other horizontal and vertical surfaces. In conclusion, the illumination of the desired faces 11 and 12 is minimal in the Ashall invention. Thus, the use of transparent sheet 10 does not increase the illumination on the desired faces 11 and 12, in Ashall. Rather it actually minimizes this illumination. A further explanation of this position is given on paragraph VII.

III. Ashall's transparent sheet 10 and Konomi's light-directing panel 8 differ in dimensions.

In Ashall's patent it is obvious in fig. 1, 2a and 2b that the width of the transparent sheet 10 is equal to the diameter of the light source 21, which for Ashall's fluorescent lamps preference, this diameter is as large as 1.5 inches or 38 mm. For the length of these lamps, which goes up to 96 inches, the use of this light-directing panel would be impractical due to the general weight of the panel. Ashall limits his panel to 60 cm x 60 cm, which translates to 24 inch x 24 inch. (Table 1, column 1, line 16)

In Konomi's patent application the light-directing panel 8 always has a width of 2mm, for all kinds of fluorescent lamps no mater what dimensions they have.

IV. The non-transparent parts, on Ashall's transparent sheet 10 and Konomi's light-directing panel 8, serve for opposite functions.

It is said that a surface is illuminated when rays go through this surface and fall in the eye of the observer. The more rays go through, the more this surface is illuminated.

In Konomi's light-directing panel 8 the non-transparent parts serve to reflect the rays from light sources 12 and 14 and to redirect them towards the surfaces that are meant to be illuminated. (Fig. 9, 11, 13, 14) (Also refer to Fig. D)

In Ashall's patent, although the function of the non-transparent parts (dots) is not shown, I believe that the rays inside the transparent sheet 10 are redirected again inside the panel and therefore are not able to go through the desired faces. If we purposely direct a light towards one of these non-transparent dots it will not allow the ray to go through it and therefore it will not allow it to illuminate the desired face. The more dots are used the less chances are that the desired face will be illuminated. (Fig. C)

In conclusion: Ashall's transparent sheet 10 and Konomi's light-directing panel 8 are transparent sheets with two parallel surfaces that differ in width, in the way the non-transparent parts are painted and in the functionality of these non-transparent parts.

Therefore, in Konomi's light-directing panel 8, the non-transparent parts direct the rays towards the desired face and maximize the illumination of this desired face (Fig. D), whereas in Ashall's transparent sheet 10, the non-transparent parts block the rays from going through the desired face and minimize the illumination of this desired face. (Fig. C)

V. <u>The use of the light-directing panel with 4 non-transparent surfaces.</u>

In Konomi's application the use of the light-directing panel 50 in a rhombic form with 4 non-transparent and non-parallel surfaces, is shown. The light-directing panel 50 is used to direct the rays originating from light sources 12 and 14, that are parallel to the desired faces, and therefore to further increase the illumination of these desired faces. The light-directing panel 8 does not realize this.

In Ashall's patent the transparent sheet 10 with two surfaces that are parallel to the two desired faces cannot be conceptualized with two or four non-transparent sides, (Regarding claim 7, pg. 4 in examiner's response) which is abstract.

Regarding claim 5 (Examiner's response, pg. 4) Konomi's patent application discusses the four sides of the rhombic light-directing panel that are actually used to direct the maximum light towards the desired faces. In Ashall's patent, the transparent sheet 10 has only two opposing sides that are used for illumination purposes. The four sides the Examiner is referring to are not discussed in Ashall's patent as they are merely used for support.

VI. Difference in the overall construction of the panels.

In Ashall's patent a transparent sheet with two parallel surfaces is placed on a supportive base, within which there is a light source. (Fig.1) On both surfaces of the transparent sheet 10, two desired faces are fixed, which on the whole gives the impression of a picture frame that is placed on a work table, and does not show the electrical circuitry which is very important in this panel and not easy in practice.

In Konomi's patent application the panel made of aluminum, has such a construction that allows room for all electrical circuitry, the fixation of the desired faces and can be used in several positions. It can be placed on the floor or a countertop, hung on the surface of the wall or hung from the ceiling. (Fig. 4) The electrical circuitry is shown in Fig 23.

VII. In point II of this material I stressed that in Ashall's patent, **no direct ray that originates from light source 21 goes through the desired faces 11 and 12.** Therefore the desired faces 11 and 12 are not illuminated by the fluorescent lamp. This conclusion is described in detail as follows:

The first requirement is the type of material used for transparent sheet 10 and the angle that is formed by the rays.

From an optical science point of view, Ashall's panel is thought to illuminate two desired faces that are fixed on two parallel surfaces of a transparent material that may be glass, plastic or

preferably acrylic, (Column 2, line 37) and the rays come from a different ambient that is air in this case. The surface where the desired faces are fixed and the surface where the light rays come from, form a 90° angle.

Assume a vertical cut of Ashall's transparent sheet 10 in a perpendicular plan with two parallel surfaces 11 and 12, and with the axis of the light source 21. (Fig. A and B)

There are two kinds of rays that originate from light source 21 and fall on surface AB:

a. Vertical, and

b. Non-vertical, forming an angle with the vertical ray.

a. When vertical rays SI enter Ashall's transparent sheet 10, which is glass, plastic or acrylic, they do not change direction. (Rays IN) These rays come out of the opposite to the light source surface DC (Fig. A) None of these rays comes out of surfaces AD (desired face 11) and BC (desired face 12).

b. The non-vertical rays that fall on surface AB are both on the right of the vertical rays as well as on the left. (Fig. B)

I will analyze one case:

The non-vertical rays S_oI, S_1I, S_2I.....S_nI form with the vertical rays SI different angles i_1, from 0° to 90°. (In Ashall's patent, there is no 90° angle)

These angles i_1 are the angles formed by the incoming rays with the vertical at a point I of surface AB. When the incoming rays fall on surface AB, which is glass or plastic, they do not continue straight, but refract, in other words, change direction within the transparent sheet 10. Since glass or plastic are thicker than the air, the refracted ray will go closer to the vertical IN forming angles i_2 that are called the angles of refraction. In other ambients this angle is different.

Any transparent ambient has an absolute coefficient of the refraction of the light that I will mark with n. Where n = V/C, V = the speed of the light in the given ambient and C = the speed of the light in vacuity. For example, in air n=1.0029, in water with 20°C n=1.33, in plastic n=1.50, in glass n=1.52, in quartz n=1.54, in diamond n=2.42 etc. I will mark the absolute coefficient of air n_1 and of glass n_2. In accordance with Renee Descartes' optical laws, incoming ray S_nI and the ray of refraction II_n are connected with the following formula: $n_1 \times \sin i_1 = n_2 \times \sin i_2$. Since the rays enter from air to glass, the angle of refraction is smaller than the angle formed by the incoming ray and the vertical at a point I of surface AB. For the maximum angle formed by incoming ray S_nI, $i_1 = 90°$, the angle of refraction is smaller than 90°, in other words $i_2<90°$. The angle of refraction i_2 is different in different ambients, in the ambient of glass it is $i_2=42°$. In physics, this angle is called the critical angle of refraction which I will mark with a ß This means that for example in glass there are no angles of refraction larger than the critical angle which is 42°.

All refracted rays II_0, II_1, $II_2 \ldots II_n$ inside Ashall's transparent sheet 10, fall either on surface AD (desired face 11) or for smaller angles on the opposite surface to surface AB, which is DC. The rays that fall on surface DC go through and out of this surface (rays I_0M) this time, going away from the vertical ray (from glass density to air density).

The rays that fall on surface AD form with the vertical axis of this surface angle i_3. Every angle i_3 in this surface is $i_3 = 90° - i_2$. The smallest angle i_3 is the angle that belongs to the critical ray of refraction, II_n. In the case of glass, this angle $i_3= 90° - ß = 90°-42°=48°$. All other angles i_3 are larger than 48°.

According to optical laws, for a ray to go through surface AD, non-parallel with AB, it is necessary for angle i_3 to be smaller than the critical angle of refraction ß; $i_3<$ ß. In this case it is

ß =42° and there is no other ray that falls on surface AD and have angle i_3< ß =42°. All rays with angle i_3> ß or in other words i_3>42°, do not go through surface AD. Those rays are reflected within Ashall's transparent sheet 10.

This phenomenon, in physics is called a complete reflection. As a result the rays that fall on surface AD of Ashall's transparent sheet 10, are completely reflected and no ray comes through surface AD to illuminate this desired face 11. Within Ashall's transparent sheet 10, the reflected rays from surface AD, fall on surface BC, and from there again they undergo a complete reflection. After a series of reflections, they fall on and go through surface DC.

The same reasoning applies for the rays on the left of the vertical ray SI and surface BC. (Ashall's reference 12)

Thus, all rays that enter Ashall's transparent sheet 10, vertical or non-vertical, through surface AB which is above light source 21, exit transparent sheet 10 only through the parallel surface to surface AB, which is surface CD. No ray exits through surfaces AD and BC to illuminate the desired faces 11 and 12.

If we place another light source over surface CD, or vertically, two other light sources, the result would be the same. No ray would exit from surfaces AD and BC to illuminate the desired faces 11 and 12.

Since the desired faces 11 and 12 must be illuminated from the back the following questions are raised:

a. Which rays illuminate these desired faces when no rays exit from these surfaces?

b. How can the illumination be increased for these two surfaces when there is no illumination?

(Column 2, lines 6-9)

c. Why is it written that "non-transparent" dots increase the illumination of these surfaces from the back, when there is no illumination achieved at all? (Column 4, lines19-21)

The second requirement is that the rays that enter through a surface to exit from a surface non-parallel to the entry surface is that the angle formed by these two surfaces be smaller than the double of the maximum angle ß of the material used. (In Ashall's case, for example glass, plastic or acrylic, ß =42°) In other words the angle formed by these surfaces must be smaller than 84°. In this case angle BAD = 90° > 84°, therefore this requirement is also not met. As a result: In Ashall's patent, no ray originating from light source 21 falls on the desired faces 11 and 12 of transparent sheet 10.

In conclusion, the comparison between applicant's application for a patent with application number 09/824,966 and Ashall's patent with patent number 5,625,968 is not correct. The reasoning behind the illumination of Ashall's panel is outside the laws of the optical science. Therefore the comparison between applicant's and Ashall's summary is not logical because both applicant's and Ashall's panels are built based on opposite scientific laws, functionality and construction. The idea is similar but the practical realization of this idea is different and in Ashall's case, the realization is not correct.

From the information derived from Ashall's patent, I was able to build a prototype and the result was what I have mentioned above. Neither one of the desired faces 11 or 12 is illuminated by light source 21.

Ashall's transparent sheet 10 is lit within itself, in other words, between the desired faces 11 and 12 but the illumination of these faces is minimal.

This minimal illumination is because inside transparent sheet 10 travel all rays that go through surface AB and go out of the transparent sheet 10 through surface CD.

The light's photons throughout this travel bump with the loose ions and electrons that the material of the transparent sheet 10 has, this way, giving a part of the energy they carry. Two phenomena take place:

a. Some photons change their direction and fall on surfaces AD and BC with angles smaller than 42° and come out of these surfaces. These rays we see with very small intensity.

b. After their crash with the photons, some ions and electrons' energy is increased and they illuminate but very weak. This illumination depends on the crystal structure of the material. It is not possible to change this structure with the loose ions and electrons therefore it is not possible to minimize or maximize the illumination within transparent sheet 10; this is explained with the corpuscular nature of the light.

In Ashall's transparent sheet 10 the desired faces are visible from a short distance due to the **contrast of the transparent part with the non-transparent part** of the faces and not due to maximization of the illumination. This is applicable for small panels.

The fixed desired faces that are printed on a film in front of surfaces 11 and 12 are dimly lit or dark. The intensity of the illumination is minimal. In panel instant invention the maximum intensity of the light is used.

The major differences between the instant invention, Easterday's and Ashall's patent have been stressed, for the construction, the optical laws that are followed, the functionality and their practical use. Therefore, in light of the entire record and the Examiner's failure to support his contention of obviousness, the prior art references of Easterday's and Ashall clearly do not

motivate or suggest making the disclosed invention, nor do they motivate or suggest all of the limitations of the disclosed invention.

Issue 2 – Whether newly added claims 20 - 31 are patentable.

Newly added claims 20 – 31 have been added by way of amendment after final rejection. Applicant submits that claims 20 – 31 are presently in condition for allowance.

Further Rejection Under 35 USC §103

The Examiner rejected claim 8 under 35 USC §103 as being unpatentable over Easterday et al. in view of Ashall as applied to claims 4 and 5 above, and further in view of Murase et. al due (U.S. Patent 5,283,673). Claim 8 has been cancelled.

Conclusion

For the extensive reasons advanced above, Applicants respectfully contend that each Claim is patentable. Therefore, reversal of all rejections is courteously solicited. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 12-0115 and please credit any excess fees to such deposit account.

Respectfully Submitted,

10/15/2003
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Appendix

Applicants' Pending Claims

What I claim is:

1. A double-sided edge lighting-type display box comprising:

two display signage panels, having a desired design face;

at least two light sources offset from and behind said two display signage panels; and

a light directing panel located behind at least one of said two display signage panels;

whereby light directly incident on said at least one display signage from said at least two light sources and redirected light from said light-directing panel backlight and illuminate said two display signage panels, or at least one display signage panel.

5. The double-sided edge lighting-type display box of claim 1 wherein said light directing panel comprises four sides.

7. The double-sided edge lighting-type display box of claim 5 wherein the light-directing panel is completely non-transparent.

9. The double-sided edge lighting-type display box of claim 1 further comprising two display signage panels having a desired design face, a first display signage panel and a second display signage panel, wherein said two light sources are offset from and located substantially equidistantly from said first display panel and said second display signage panel; and said light directing panel is located substantially equidistantly between said two display signage panels whereby light directly incident on each display signage panel from said two light

sources and redirected light from said light-directing panel backlight and illuminate said first display signage panel and said second display signage panel.

10. The double-sided edge lighting-type display box of claim 1 wherein said two display signage panels have substantially the same height and length.

12. The double-sided edge lighting-type display box of claim 1 wherein said light-directing panel is substantially the same height as the said two display signage panels.

13. The double-sided edge lighting-type display box of claim 4 or 5 wherein said light-directing panels have substantially the same height as the glass portion of the said two light sources.

15. The double-sided edge lighting-type display box of claim 14 wherein the interior of said housing is at least partially reflective surfaced for reflectively directing light toward said two display signage panels or at least one display signage panel.

20. A double-sided lighting-type display box comprising:

two display signage panels having a desired design face;

at two parallel linear florescent light sources offset from and behind said two display signage panels; and

a light directing panel located behind said two display signages;

wherein light directly incident on said two display signages from said two parallel linear florescent light sources and redirected light from said light directing panel backlight and illuminate said two display signage panel.

21. The double-sided edge lighting-type display box of claim 20 wherein said two display signage panels are substantially the same height as the glass portion of the said two light sources.

22. The double-sided edge lighting type display box of claim 20 wherein the overall thickness of the double-sided edge lighting type display box is 1 inch larger than the diameter of the said fluorescent light source.

23. The double-sided edge lighting-type display light box of claim 20 wherein said light-directing panel comprises two parallel sides with thickness of 2mm that are 50% transparent and 50% non-transparent.

24. The double-sided edge lighting-type display light box of claim 23 wherein at least a portion of the light-directing panel, on both sides, is substantially non-transparent in the form of a triangle with its base in the middle of the light-directing panel and its top angle at the light source, wherein the degree of the top angle is 1.73 degrees and the transparent part of the light directing panel is also in the form of a triangular with its top angle at the center of the light-directing panel with a degree of 1.73 degrees and wherein the non-transparent parts on both sides of the light-directing panel are parallel.

25. The double-sided edge lighting-type display light box of claim 24 wherein the distance between said two fluorescent light sources should not be greater than .6 of their length.

26. The double-sided edge lighting-type display light box of claim 20 wherein said light-directing panel comprises four reflective sides two and two parallel to each other in a prismatic rhombus form where the smaller diagonal of the base is equal to the diameter of the said linear fluorescent light source.

27. The double-sided edge lighting-type display light box of claim 26 wherein the light directing panel is completely non-transparent and the plane that passes through the larger diagonal of the base lays throughout the plane of the two axis of the fluorescent light source and equidistantly from the design faces.

28. The double-sided edge lighting-type display light box of claim 20 wherein said two parallel fluorescent light sources are located substantially equidistantly from said first display signage panel and second display signage panel and the requirement that the light source's distance from the middle of the display signs be the same as the light source's distance from the side of the display signs for a uniform illumination.

29. The double-sided edge lighting-type display light box of claim 20 further comprising of a housing that has a unique profile for supporting a parabolic reflector for

reflecting light from the back side of the fluorescent lamps to the said two display signage panels or at least one display signage panel.

30. The double-sided edge lighting-type display light box of claim 29 wherein said housing with a unique profile for supporting said two linear fluorescent light sources within the housing and in front of the parabolic reflector.

31. The double-sided edge lighting-type display light box of claim 20 wherein said two display signage panels have substantially the same height and length as the light-directing panel.